

WHAT IS CLAIMED IS:

1. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes comprising:

a single or a plurality of magnets for exciting magnetic fluid accumulated within the subject; and

a plurality of magnetic sensors for detecting the distortion of the local magnetic distribution due to the magnetic fluid excited by the magnets;

wherein any of the magnet, the combination of the magnet and the plurality of the magnetic sensors, and the combination of the magnet, the plurality of the magnetic sensors, and a preamplifier for amplifying the outputs from the plurality of the magnetic sensors, is vibrated or rotated, and the difference between the outputs from the plurality of the magnetic sensors is obtained and is subjected to demodulation, thereby detecting the magnetic fluid.

2. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes comprising:

a single or a plurality of electromagnets for exciting magnetic fluid accumulated within the subject; and

a plurality of magnetic sensors for detecting the distortion of the local magnetic distribution due to the magnetic fluid excited by the electromagnet;

wherein the electromagnet is driven by AC current, the

difference between the outputs from the plurality of the magnetic sensors is obtained, and is subjected to demodulation, thereby detecting the magnetic fluid.

3. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 1, wherein the two magnets are disposed in parallel in the same direction of polarity;

and wherein the plurality of magnetic sensors are disposed between the two magnets.

4. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 1, wherein the magnet comprises a U-shaped magnet or a horseshoe-shaped magnet, and wherein the plurality of magnetic sensors are disposed so that the U-shaped magnet or the horseshoe-shaped magnet surrounds the plurality of the magnetic sensors.

5. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 1, further comprising an actuator for vibrating or rotating any of the magnet, the combination of the magnet and the plurality of the magnetic sensors, and the combination of the magnet, the plurality of the magnetic sensors, and the preamplifier.

6. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 1, wherein the magnet, the magnetic sensors, the actuator, and the preamplifier, are included in a single watertight probe

formed of non-magnetic material.

7. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 2, wherein the electromagnet is disposed and driven such that the electromagnet has small influence of the magnetic field upon the magnetic sensors, and has great influence of the magnetic field upon the magnetic fluid, due to the interaction of the magnetic field formed by the electromagnet.

8. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 2, wherein the electromagnet has a ferrite magnetic core formed of a U-shaped magnet or a horseshoe-shaped magnet, and wherein the plurality of magnetic sensors are disposed so that the U-shaped magnet or the horseshoe-shaped magnet surrounds the plurality of magnetic sensors.

9. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 2, further comprising a driving circuit for driving the electromagnet.

10. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 2, wherein the electromagnet, the magnetic sensors, and the preamplifier, are included in a single watertight probe formed of non-magnetic material.

11. A magnetic fluid detecting apparatus for identifying

sentinel lymph nodes according to Claim 2, wherein the magnetic sensors are formed of thin-film sensors, and the electromagnet is formed of a thin-film coil and a thin-film magnetic material; and wherein these components are formed on the same semiconductor substrate as the preamplifier.

12. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 7, wherein the plurality of electromagnets are disposed at the positions where the change of the magnetic field over time does not occur, and wherein magnetic sensors are disposed at the positions where the change of the magnetic field does not occur.

13. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 7, wherein the electromagnet is formed of two electromagnets, one great and one small, disposed concentrically with each other.

14. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 7, wherein the electromagnet is formed of two electromagnets disposed in parallel, with current applied to the electromagnets so that the polarities are formed in the same direction, and wherein the magnetic sensors are disposed between the electromagnets and oriented so as not to be influenced by the magnetic field therefrom.

15. A magnetic fluid detecting apparatus for identifying

sentinel lymph nodes according to Claim 4, wherein the magnetic sensor comprises an MI (Magnetic Impedance) sensor or an MR (Magnetic Resistance) sensor.

16. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 8, wherein the magnetic sensor comprises an MI (Magnetic Impedance) sensor or an MR (Magnetic Resistance) sensor.

17. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 5, further comprising a driver for driving the actuator, wherein the driver or the preamplifier is magnetically shielded.

18. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 9, wherein the driving circuit is magnetically shielded.

19. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 10, wherein the preamplifier is magnetically shielded.

20. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 12, wherein the plurality of electromagnets are disposed symmetrically in the vertical direction, with a single or a plurality of magnetic sensors for the electromagnets being disposed for detecting the magnetic field formed by the plurality of the electromagnets;

and wherein feedback is performed for a predetermined

electromagnet of the plurality of electromagnets so that the outputs from the magnetic sensors for the electromagnets or the sum of these outputs are maintained constant.

21. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes comprising:

a single or a plurality of magnets for exciting magnetic fluid accumulated within the subject;

a plurality of magnetic sensors for detecting the distortion of the local magnetic distribution due to the magnetic fluid excited by the magnets; and

a variable offset unit for offsetting the difference between the outputs from the plurality of the magnetic sensors;

wherein any of the magnet, the combination of the magnet and the plurality of the magnetic sensors, and the combination of the magnet, the plurality of the magnetic sensors, and a preamplifier for amplifying the outputs from the plurality of the magnetic sensors, is vibrated or rotated, and the difference between the outputs from the plurality of the magnetic sensors is obtained and is subjected to demodulation, thereby detecting the magnetic fluid;

and wherein the variable offset unit adjusts the amount of the offset based upon the output from the preamplifier.

22. A magnetic fluid detecting apparatus for identifying

sentinel lymph nodes according to Claim 21, wherein the variable offset unit comprises a CdS photocoupler.

23. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes comprising:

a single or a plurality of magnets for exciting magnetic fluid accumulated within the subject;

a plurality of magnetic sensors for detecting the distortion of the local magnetic distribution due to the magnetic fluid excited by the magnets; and

a variable offset unit for offsetting the difference between the outputs from the plurality of the magnetic sensors;

wherein any of the magnet, the combination of the magnet and the plurality of the magnetic sensors, and the combination of the magnet, the plurality of the magnetic sensors, and a preamplifier for amplifying the outputs from the plurality of the magnetic sensors, is vibrated or rotated, and the difference between the outputs from the plurality of the magnetic sensors is obtained and is subjected to demodulation, thereby detecting the magnetic fluid;

and wherein the plurality of the magnetic sensors and the preamplifier form an AC coupling configuration.

24. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes comprising:

a single or a plurality of magnets for exciting magnetic fluid accumulated within the subject; and

a plurality of magnetic sensors for detecting the distortion of the local magnetic distribution due to the magnetic fluid excited by the magnets;

wherein any of the magnet, the combination of the magnet and the plurality of the magnetic sensors, and the combination of the magnet, the plurality of the magnetic sensors, and a preamplifier for amplifying the outputs from the plurality of the magnetic sensors, is vibrated in the direction parallel to a line or a plane including the plurality of the magnetic sensors, and the difference between the outputs from the plurality of the magnetic sensors is obtained and is subjected to demodulation.

25. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 24, further comprising a variable offset unit for offsetting the difference between the outputs from the plurality of the magnetic sensors, wherein the variable offset unit adjusts the amount of the offset based upon the output from the preamplifier.

26. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 24, wherein the plurality of the magnetic sensors and the preamplifier form an AC coupling configuration.



27. A magnetic fluid detecting apparatus for identifying sentinel lymph nodes according to Claim 25, wherein the variable offset unit comprises a CdS photocoupler.